Manufacture of Files

For many years files were made entirely by hand, and at the present time the best files are still made in the same way. The file may be called a metal-cutting or abrasion tool, and it removes the metal by means of a series of sharp-edged parallel ridges all inclined at an angle of about 50 degrees to the axis of the tool. There are numerous types of file differing in fineness of cut. These are all divided into two broad classes of "double cut" and "float cut," or a "single cut." The former have two rows of cutting edges equally inclined to the axis and the latter have only one. In preparing the files steel blanks are first forged from bars which have been previously sheared or rolled to the section require for the tool. The blank is, of course, of soft steel. It is held on the anvil by a strap which passes round the tang, and is held down by the foot of the operator. If the under side has been cut already or is not flat, it is protected from damage by interposing lead or pewter as a soft support. Then, using a chisel which is rather wider than the blank, the operator makes a series of cuts parallel to each other and at the proper angle. The hammer is chosen with great care to be of such a mass as to cause the burr from each cut to rise to the right height. The distance of one cut from the next is gaged by resting the inclined chisel against the last burr when cutting the next. By increasing the slope of the chisel the distance apart of the burr is increased and vice-versa. It is obvious that the greatest skill and practice is required to strike, the chisel with the right force, and to keep its inclination constant over many hundreds of cuts. The height of the burrs as well as their distance from each other governs the fineness or coarseness of the cut. In the ordinary double-cut flat file there are 6 degrees of fineness respectively, called rough, middle, bastard, second cut, smooth, and dead smooth. Float-cut files are made in rough, bastard, and smooth varieties. In making double-cut files the first series of cuts are smoothed over very slighlty before making the second series. Lancashire used to make the best files, and even now no place can compete with it for the finest files, such as watchmakers use. The author of a classic work on the manipulation of metals, mentions a fine Lancashire file on which he counted 300 cuts to the inch.

The rasp cuts in virtue of a number of triangular-shaped projecting burrs distributed over its surface. These are made with a three-cornered pointed punch or chisel. They are distributed as evenly as possible, the great object of the file-cutter being to arrange that one cut shall not come behind another. There is thus great skill in arranging by the eye a pattern in which the number of cuts per square inch shall be uniform and yet in which they they are irregularly placed relative to the axis of the tool. Rasps, again, are made in rough, bastard, and smooth cuts. The wide use of aluminium has brought into use files of the "dreadnaught" type. In these the cut is single and is normal to the axis, or nearly so. It is very coarse, and the teeth are deep and triangle in section. As a rule they are not straight, but are shaped in ares or circles arranged parallel to each other. This coarse type of file is necessary because the aluminium being soft rapidly clogs the teeth of ordinary files, making the edges so that they will not cut. The writer knows an old metal patternmaker who has to file up metal patterns, often on very awkward concave surfaces. For this purpose he takes old files, and, having softened them, cuts straight dreadnought-type teeth with a small three-cornered file. The files are then bent to suit the cavities and corners which have to be worked, and are rehardened by heating and plunging into oil. In this way he has made a most ingenious set of tools by which almost impossible jobs are performed with ease and accuracy. Returning to the orthodox file cut in the softblank, the next process is to straighten the file out accurately. It is then hardened, the teeth being protected from getting burnt in the heating process. After hardening the quality of cut is improved by exposure to a blast of fine sand.

Numerous attempts were made, even in the eighteenth century to devise machines to replace the hand file-maker. These all attempted to imitate his action by means of an arm carrying a chisel, the latter being struck by a hammer which is operated mechanically. The successful machines of the present day carry the blank on a table which advances very slowly under a chisel or hammer which reciprocates rapidly. By varying the rate of transverse of the table the coarseness of the cut can be altered. But it still remains a fact that the hand operator can make the best file, and this is attributed, curiously enough, to the advantage of a certain amount of irregularity in the teeth of a hand-cut file, which it is very difficult, if not impossible, for a machine to imitate. —London *Daily Telegraph*.

Wear in Big Guns

In the current number of *Arms and Explosives* Major T. G. Tulloch (late R.A.) gives an article of much interest at the present time dealing with the wear of large guns. As the author points out, the wear of such guns has a most important influence on the cost of the war, not only on account of the expense of effecting repairs but because such wear leads to inaccuracy of fire and so increases the amount of ammunition expended to attain a definite objective. On this point he says, "In short, if a few thousandths of an inch of steel at the commencement of the rifling of guns, etc., could be prevented from wearing away in so short a time as at present, the reduction in the cost of the war, so far as guns, ammunition, transport, etc., are concerned, is almost incalculable." In dealing with this matter, Major Tulloch differentiates between the damage to the bore near the breech end—damage for which he retains the usual term "Corrosion"—and that near the muzzle which he prefers to call "erosion" as it is a purely mechanical effect. The causes which produce the first-named class of damage are complex, and include the effects of temperature, the form and dimensions of the powder chamber, the chemical and physical qualities of the powder used, the weight of charge and rapidity of fire, the gas escape past the projectile, and the composition and physical properties of the steel used for the inner tubes of the gun. All these matters present many points of interest and they are discussed clearly in the article with which we are dealing. Major Tulloch attaches much importance to the evolution of methods for securing the effective sealing of the gas escape immediately after the firing of the charge, and he makes some suggestions as to the lines on which such a device may be designed. As regards the physical properties of the steel used for the inner tube, Major Tolluch considers that the heat treatment should be subject to the analysis of the steel and the forging effect, and he urges the necessity of obtaining more effective forging of the portion of the tube forming the bore, and suggests certain methods of securing this result. With regard to the erosion near the muzzle due to frictional wear and metallic fouling, it is pointed out that to secure good shooting it is desirable to prevent such fouling by all practicable means, such as slightly bell-mouthing the bore, and, as indicative of the importance of this matter, he states that by electrolytic methods over 15 pounds weight of copper have been removed from the bore of an 8-inch gun after firing just over 100 rounds. In concluding his most interesting article, Major Tulloch remarks that it was written to invite discussion and to call attention to certain matters requiring systematic investigation, and we much hope that it may have this result.—*Engineering*.

Russian Timber Importation in France

Russian wood is largely imported into France, speaking of course of normal times. In 1913 France imported wood to the extent of $35,000,000, in which lumber figured for $28,000,000, and half of the total amount came from Russia. This is introduced mainly by the northern ports. Outside of sawed lumber, the Russian wood includes telegraph poles, mine timber, wood for paper manufacture, etc., as well as a certain amount used for manufacture of matches and for veneering. Oak wood is imported mainly for railroad ties. Wood pulp is also likely to become a prominent article.

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